

The Disruption Of Ecosystems In The City Of Kinshasa: Issues Of Ecological Awareness For The Populations Concerned.

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Abstract

Education in ecological values is a priority. The ecological importance of the living environment allows for a harmonious balance of human and natural health. On the other hand, environmental mismanagement leads to the degradation of ecosystems. The city of Kinshasa is a case in point. Thus, the acceleration of the biospheric entropy disturbs the usual rhythm of our planet; and according to the thermodynamic principles of the systems, can precipitate the end of humanity whereas the ecosystems have vital services to render to the man.

What are the benefits that the populations of Kinshasa obtain from their ecosystems and their biodiversity? This is the question that the authors of this article ask themselves.

In fine, it is more a question of making the Homo sapiens of Kinshasa aware of the need to reconsider its way of managing ecosystems in order to limit and reverse the intensity of the damage caused. The expression 'One Health' calls out to us and it is time for all actors, under the guidance of the city managers, to get to work, otherwise disaster is at hand.

Keywords: Services provided - disturbance - ecosystems - ecology - environment - biodiversity – Kinshasa

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I. Introduction

In this study, the focus is on the well-being of humankind, which is entirely dependent on nature. In today's increasingly interconnected world, it is clear that the management of animal and human health includes the health of the planet. These three dimensions are interlinked and must complement each other; in other words, all living beings enjoy a single health.

In the quest for well-being, over 150 countries recognise the right to a safe, clean and healthy environment in one way or another. This right is based primarily on a safe climate, access to water supply and sanitation services, clean air, healthy and sustainably produced food, non-toxic environments, healthy ecosystems and respect for biodiversity. These conditions are essential to human health and our resistance to disease. They are also essential for reducing the risks associated with zoonoses and avoiding the multiplication of existing disease vectors

(https://waps.ohchr.org/sites/default/files/Documents/Issues/Climatechange/COVID19_FR.pdf consulted on 13 February 2021 at 13:15).

Furthermore, Pope Francis, in his encyclical letter LAUDATO SI' (2015), invites us to safeguard our common home, to protect and improve the world by changing lifestyles, production and consumption models, and the established power structures that govern societies today. Safeguarding ecosystems therefore requires us to look beyond the immediate, because when all we're looking for is a quick and easy economic return, preserving them is of no real interest to anyone. But the cost of the damage caused by selfish neglect is much higher than the economic benefit that can be gained.

<https://oise.catholique.fr/eveque-et-ses-collaborateurs/commission-laudato-si/laudato-si-extraits-choisis>

The Democratic Republic of the Congo plays a key role in the world's ecological balance, and is therefore a major player in the current debate on climate change. In terms of biodiversity, it is counted among the ten countries in the world holding the most wealth (MECNT, 2015).

However, the landscape's biodiversity in general is under threat, the pressure on its natural resources is great (Sankiana, 2012) and its capital Kinshasa, the subject of this study, is not spared by the environmental disaster of recent decades.

Built on the left bank of the great Congo River, it is home to a population of around 18 million. Outside the liquid border, the suburbs are made up of savannah interrupted in places by bushes on hydromorphic soil in its flat part, and sandy soil in the rest. Ecosystems that used to provide vital ecological services to the population are undergoing unprecedented corruption, at the risk of becoming the population's enemies.

The river that once provided clean water, fish and entertainment is now polluted. Some green spaces have been decimated in favor of construction. The city's soil is eroding, gullyng, "sachétizing" and polluting in ways that go unnoticed.

The rivers that flow into the river are seriously polluted by excreta; the city's air is vitiated by the gases released by machinery, the nauseating odors of excreta and poorly managed waste. The consequences of this dysfunction can be seen in global warming, disease, stress...

Reacting to these problems, the main question of this study is: are Kinshasa's ecosystems providing goods and services to the population, and if there is disruption to these ecosystems, is it natural or provoked?

The hypothesis supported by this research is that the ecosystems of the city-province of Kinshasa are no longer providing the megalopolis with the goods and services that have traditionally been attributed to them. Urgent action is needed to save the capital of DR Congo from imminent disaster.

The aim of this study is to assess the services provided by Kinshasa's ecosystems for the well-being of the population, and to identify the resulting weaknesses in order to optimize them.

In concrete terms, it consists of:

- Taking stock of Kinshasa's ecosystems and detailing their current situation;
- Call on public authorities to take effective measures to preserve these ecosystems;
- Make the community aware of the dangers of disrupting the ecological functions of different ecosystems, and encourage it to take responsibility for its own actions.

II. Environment

Location

The city of Kinshasa is located at 40°19' south latitude and 15°18' west longitude, with a population estimated for the year 2015 at 11,575,000 inhabitants (INS, 2015, p.66). Its surface area covers 9,965 km², or 0.42% of the national territory (Saint Moulin and Kalombo, 2005 cited by Shomba K et al. 2015). In the absence of a general population census, a natural growth rate of 2.9% (INS, 2015) was applied to obtain population projections for the coming years.

Its relief is composed of a marshy and alluvial plain, is built on a contrasting topographic site, because it is both comfortable (the plain: the lower town) and constraining (the hills: the upper town). It is limited:

- To the east, the provinces of Mai-Ndombe, Kwango and Kwilu;
- To the west and north by the Congo River, forming a natural border with the Republic of Congo, and to the south by the province of Kongo Central (https://geocotrop.be/uploads/publications/pub_461_09.pdf).

Climate

The umbrothermal diagram below (Figure 1) shows the different climatic aspects of the city of Kinshasa.

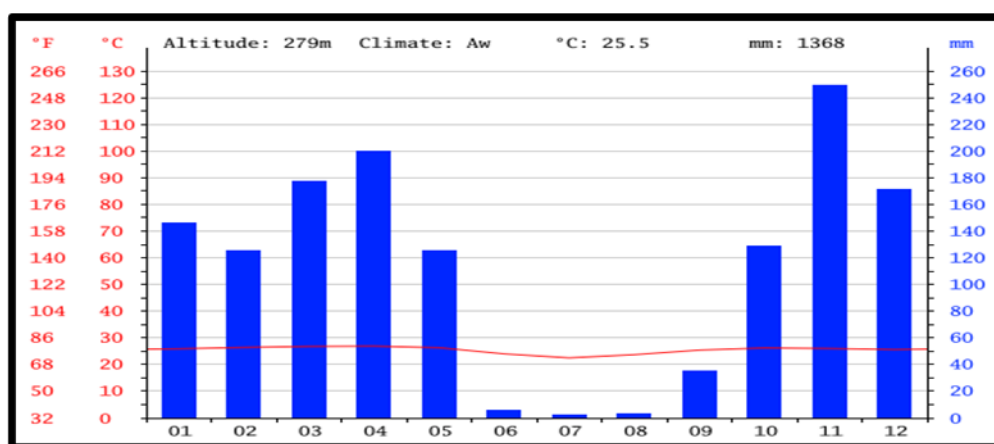


Figure 1: Diagramme ombrothermique de Kinshasa

Source: <https://fr.climate-data.org/afrique/congo-kinshasa/kinshasa/kinshasa-408/#climate-graph> - Accessed on 12 February 2021 at 12:34'.

Hydrography

Kinshasa's hydrographic network comprises the Congo River and its main left-bank tributaries, most of which criss-cross the city from south to north. These are mainly the Lukunga, Ndjili, and Nsele, Bombo or Mai-Ndombe and Mbale rivers. (Sala, M., Miemuns, G., 2020). Its rivers are currently polluted as a result of the lack of adequate sanitation and the city's demographic pressure (Shomba K et al. 2015).

The rivers are one of the capital's essential means of water drainage, sometimes causing flooding and erosion, due to poor urbanization in certain parts of the city (Sala, M., Miemuns, G., 2020). The Congo River, which forms a natural border between the cities of Kinshasa and Brazzaville, is one of the aquatic ecosystems that provide enormous services to the populations of the two neighboring shores.



Figure 2 : Réseau hydrographique de Kinshasa (De Saint Moulin, 2005 cité par Biloso, 2008)

Soil and vegetation

Generally speaking, Kinshasa's soil is of the Arenoferralsol type of the Congo soil classification. These soils are made up of fine sands with a low organic matter content and a low degree of saturation of the absorbent complex (https://www.memoireonline.com/10/12/6390/identification-des_espèces-fourragères-pouvant-tre-utilisées-dans-l'aménagement-de-pturages.html) consulted February 24 at 9:00 pm.

The initial vegetation of Kinshasa, in several areas, consisted of gallery forests on the one hand and grassy formations on the other. The gallery forests along the main watercourses, in the humid valleys and of the Guineo-Congolese ombrophilous type, are now only heavily degraded, intensively exploited pre-forest fallows in the form of forest recruts of various ages (https://geocotrop.be/uploads/publications/pub_461_09.pdf).

III. Study Methodology

To carry out this study, we began by researching existing literature on the issue of goods and services provided by ecosystems to the population worldwide, in the DRC and in Kinshasa. Then, we resorted to direct observation in the field, with the advantage of analyzing sites in the state in which each ecosystem plays its natural role and their interdependence. Lastly, we spoke to officials from a number of departments: Town Hall, Environment, Nature Conservation and Sustainable Development, Tourism, Mettelsat, Regideso, Energy, Agriculture, and the managers of sites such as Lac de ma vallée and the Bonobos sanctuary in the commune of Mont-ngafula.

We also interviewed a number of local residents (local neighbors, students, teachers, resourceful people, etc.). Written and electronic sources were also consulted to complete the information.

IV. Results

Our study adopts two kinds of ecosystem classification: according to biotope (living environment) or according to biocenosis (living beings) (<http://www.teteamodeler.com/ecologie/biologie/ecosysteme/index.asp>).

The most widely used classification method is that based on biotope, i.e. environment. Our analysis focuses on Kinshasa's ecosystems, i.e. terrestrial ecosystems (forests, savannahs, green spaces and urban gardens, etc.) and aquatic ecosystems (rivers, lakes, ponds). Both categories include flora and fauna, which we'll take a moment to mention. Kinshasa's highly diversified ecosystems, both terrestrial and aquatic, are unfortunately in a state of perpetual degradation as a result of numerous anthropic pressures.

Kinshasa's terrestrial ecosystems

Terrestrial ecosystems provide humanity with a wide range of benefits known as "ecosystem goods and services". Goods produced by ecosystems include food (meat, fish, vegetables, etc.), water, fuel and wood, while services include water supply and air purification, natural waste recycling, soil formation, pollination and the regulatory mechanisms that nature, left to its own devices, uses to control climatic conditions and populations of animals, insects and other organisms.

Because many of these goods and services have always been available free of charge, outside markets and prices, their true long-term value is not included in society's economic estimates.

Flora

Kinshasa's vegetation consists of forests, savannahs and the semi-aquatic and aquatic formations of the Pool Malebo valleys. There are also grassy formations with a generally herbaceous upper stratum of at least 80 cm, sometimes sparsely interspersed with isolated trees or shrubs or in groves, which overhang a lower herbaceous stratum comprising hemi cryptophytes and geophytes

(<https://www.memoireonline.com/10/12/6390/identification-des-especes-fourrageres-pouvant-tre-utilisees-dans-l-aménagement-de-pturages.html>) consulted February 26 at 6:00 pm.

It includes:

➤ secondary semi-caducifoliate, meso-xerophilous forests corresponding to sandy and sandy-clay soils (Compere, 1970) and Guinean-type shrub savannahs are observed in the Commune of Mont Ngafula. However, under the impact of uncontrolled housing development and urban expansion, these forests have almost disappeared. Today, they only exist in the form of forest patches, most of which have been deforested, especially where they are close to housing estates. <https://www.memoireonline.com/10/12/6390/identification-des-forage-species-can-be-used-in-landscaping.html> - Accessed February 26 at 19:00.

➤ Wooded, grassy and shrubby savannahs:

- Vegetation generally consisting of savannahs dotted with shrubs and interspersed with steppes and gallery forests of low density (<http://www.tropicultura.org/text/v36n3/478.pdf>) and size (Plateau des Bateke);

- Steppe savannahs or steppes, with Zambezi characteristics (Commune de Maluku: east and south of the Plateau);

- a mosaic of shrub savannahs dominated by *Hymenocardia acida*, *Annona senegalensis* or *Sarcocephalus latifolius*, herbaceous savannahs formed by a continuous vegetation carpet characterized by *Loudetia demeusei* and *Hyparrhenia diplandra*;

- Highly degraded relict riparian vegetation consisting of *Berlinia Bruneelii*, *Alchornea cordifolia* and *Paramacrolobium coeruleum* (a fringe of which can be seen along the N'sele river upstream of the bridge on the Kinshasa-Kikwit road).

- Swamp vegetation grows in the Pool Malebo: characteristic species include *Alstonia congolensis*, *Hallea stipulosa*, *Raphia sese*, *Harungana madagascariensis*, *Lasimorpha senegalensis* and *Afromum angustifolium*.

The overall observation is that these forests on the outskirts of Kinshasa have been decimated by human activity (agriculture and logging for charcoal and firewood).

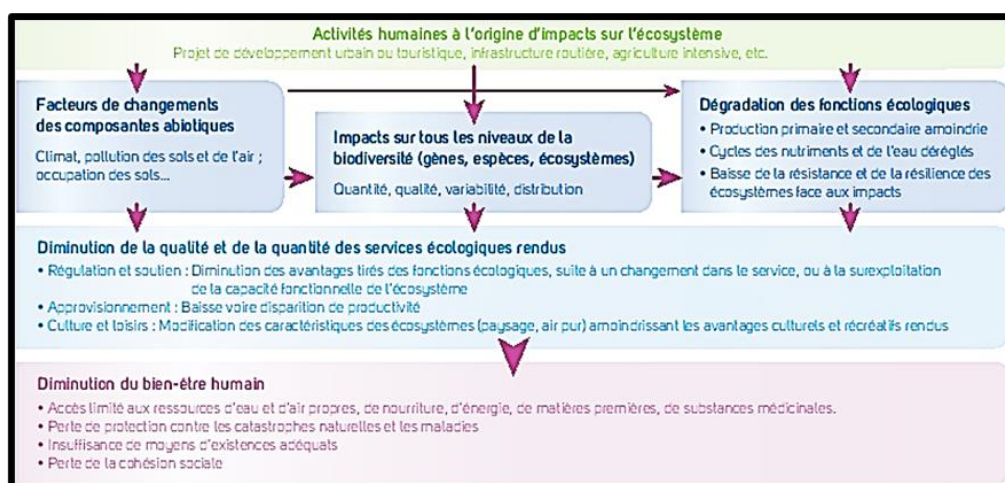


Figure 3: Human activities and ecosystem degradation

Source: IUCN-France, 2012

- Green spaces and gardens:
- In Ngaliema: - Cercle hypique
- In Gombe:
 - Botanical garden (Parc de Boeck)
 - The zoological garden
 - Golf de Kinshasa
 - Premiers/primature gardens



Figure 4: Kinshasa Botanical Garden

- In Kinkole: - Nganda Yala
 - Garden of Eden
- Maluku: - Little Paradise
- Mont-Ngafula: - Lukaya Falls
 - Lake of my valley
 - Bonobo sanctuary

All these spaces provide the population with leisure, recreation, shade, microclimates, oxygen and CO₂, leaves, bark, overgrowth... In short, green spaces are for the urban living environment, for human well-being, for biodiversity and the environment.

Green spaces destroyed or despoiled :

- Green spaces along Boulevard Lumumba and Boulevard du 30 juin,
- The Limete residential gallery forest (7e rue Limete or zamba avocats),
- Eucalyptus green spaces (N'djili district 1),
- Place des évolués in La Gombe,
- Ndangi forest,
- Mont Fleury green spaces,
- Mbenseke-Futi green spaces,
- Binza Météo green spaces,
- Mitendi green spaces,
- Kinkole green spaces,
- ONPTZ green spaces (Masina Sans-fil)
- Lukunga forest, etc.

The determining causes of the destruction and despoliation of these green spaces in Kinshasa are, on the one hand, legal and conjunctural causes, and, on the other, structural causes.

➤ Peri-urban and urban agriculture in Kinshasa: The aim of this type of agriculture is to ensure the production of eco-compatible, healthy, nutritious and economical food, to improve air quality, to combat concreting and, above all, to counterbalance climatic imbalances and improve health conditions.

It is also important in terms of food security. However, the concentration of metals in roadside vegetables is at least twice as high as in supermarket produce (Musibono D.E., 2008). Particular attention should be paid to tomatoes, which are extremely contaminated in urban environments, with cadmium and nickel levels 5 to 11 times higher than those grown in the countryside (Saumel & al., 2012). Peri-urban agriculture produces huge quantities of different vegetables (tomatoes, peppers, celery, okra, etc.) that are sold in the city. The main sites are Kimwenza village, N'djili CECOMAF and brasserie, N'sele, Ngwele and all along the river (Our surveys, December 2020).

In essence, the main services provided by this agriculture are:

- reducing food insecurity through the availability in quantity and quality, the permanent supply of various market garden produce and the population's accessibility to these vegetables;
- protect the environment by cleaning up the urban environment and preserving vegetable diversity;
- improve the socio-economic status of the family, especially women;
- increase farmers' household incomes and create jobs;
- contribute to the city's sustainability.

And in response to Covid-19, hospitals, healthcare facilities and individuals are producing more waste than usual, including masks, gloves, gowns and other protective equipment that could be infected by the virus. There has also been a sharp increase in the amount of single-use plastics produced. Poor management of these can lead to uncontrolled dumping, releasing toxins into the environment and causing secondary transmission of disease to humans. Other wastes can reach water sources and exacerbate river and marine pollution (https://www.researchgate.net/publication/343290329_Analyse_de_l'impact_du_COVID-19_dans_la_gestion_et_le_traitement_desdechets_solides) Retrieved, February 27, 2020

The quality and quantity of drinking water are poor, given that the World Health Organization standard is 100l per day for a family of 5 (drinking and hygiene) and a distance of less than one km between the supply point and the home (accessibility) (WHO et al., 2003).

Given this standard, thousands of Kinshais still have no access to water, i.e. around 35% of the population (MICS, 2010). As we can see, the city of Kinshasa is not spared from this scourge. The expressed need of the population of Kinshasa is estimated at at least 730,000m³ (REGIDESO, 2014). The combined production capacity of four Régideso plants in Kinshasa is equivalent to 484,000m³ per day, which may have increased with the latest rehabilitation work, but the water deficit in the city of Kinshasa remains high compared with estimated needs of 750,000 m³ /day. That said, the Service National d'Hydraulique Rurale (SNHR) and other private companies are doing their utmost to supply outlying districts by drilling or developing springs, but there is still a long way to go. As a result, some households rely on rainwater, wells or river water, which is less safe for their health.

Kinshasa's wetlands

Wetlands are among the most diverse and productive ecosystems. They provide essential services and all our fresh water. In Kinshasa, they continue to be degraded and transformed for other uses. Swamps, marshes and wet meadows are in sharp decline as a result of uncontrolled urbanization. The most striking example is the Ngwele, Ndanu, Debonhomme, de Marais and Masina rail districts, where everything is in the process of being conquered for housing, unaware that these environments have an important ecological role to play (multiplication of microorganisms, water purification, etc.). It's true that these places are vital to the survival of populations. They are among the most productive environments in our earth's ecosystem.

V. Conclusion

Ecosystem services remain essential to the harmonious life of human communities. However, ecosystems in and around Kinshasa are undergoing major disruptions that are reducing their capacity. To be effective, responses to environmental crises must be global and based on the principles of solidarity, compassion, respect for human dignity and ecological integrity (https://waps.ohchr.org/sites/default/files/Documents/issues/ClimateChange/COVID19_FR.pdf consulted on February 13, 2021 at 4:00 pm).

Thanks to the method of observation and documentary analysis, supplemented by interviews, we have apprehended the situation and established the findings according to which:

- the Congo River at Malebo Pool and its minor tributaries in Kinshasa are becoming progressively polluted;
- the soil in Kinshasa has fallen victim to the phenomenon of "sachétisation" and pollution by excreta, so that it can no longer properly perform its biochemical and ecological functions;
- the air is vitiated by the fumes emanating from machinery and the uncontrolled incineration of bags and other waste;
- green spaces are poorly managed and further reduced. This leads us to verify our initial hypothesis that Kinshasa's ecosystems are no longer providing the services expected of them as a result of anthropogenic disturbance.

So, in order to enable the various ecosystems to play their proper role in providing ecological services to the human community of Kinshasa, we suggest the following:

- That the provincial government, as the guarantor of the population's well-being, rapidly takes stock of the situation. Then, put in place dynamic structures to ensure that ecosystems are preserved and conserved against

degradation and despoliation. This, so that they can provide the city and its inhabitants with the ecological services they expect;

- That a green brigade be set up to monitor and prevent uncivil acts of environmental pollution caused by the dumping of industrial and household waste;

- That a department be set up with adequate resources to manage the city's waste and litter effectively and sustainably;

- That the municipal authorities re-plan the subdivision of the uninhabited part of the city, envisaging the creation of new green spaces, the extension of existing ones, and the recovery and rehabilitation of despoiled areas.

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